EAGLE CAP CONSULTING

CH2MHILL

An Investigation of Rare Plant Resources Associated with the Proposed Kittitas Valley Wind Power Project (Kittitas County, Washington)

Prepared by:

Eagle Cap Consulting Inc.
4130 SW 117th, #148
Beaverton, Oregon 97005

and

CH2M HILL
825 NE Multnomah
Suite 1300
Portland, Oregon 97232-2146

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ABREVIATIONS AND ACRONYMS

aMW	Average Megawatt(s)
BPA	Bonneville Power Administration
C	Centigrade (Celsius)
cm	Centimeter(s)
ECCI	Eagle Cap Consulting Inc.
EIS	Environmental Impact Statement
GIS	Geographic Information System
GPS	Geographic Positioning System
ha	Hectare(s)
km	Kilometer(s)
kV	Kilovolt(s)
m	Meter(s)
MW	Megawatt(s)
NRCS	Natural Resources Conservation Service
PNL	Pacific Northwest National Laboratory
USFWS	US Fish and Wildlife Service
WNHP	Washington Natural Heritage Program

EXECUTIVE SUMMARY

Zilkha Renewable Energy, LLC (Zilkha) is proposing to build a wind power facility northwest of the town of Ellensburg, Washington. The project would consist of 100-150 turbines, and have a peak production capacity of up to 250 megawatts. In addition, supporting facilities would be constructed, such as access roads, electrical lines, and an electrical substation. As part of the permitting process, Zilkha is analyzing potential impacts that the project may have on environmental resources. This includes, an investigation of rare plant resources, which is in the process of being conducted. This report presents the 2002 results of the investigation.

The rare plant investigation began with a prefield review of existing data to determine the rare plant species with potential for occurrence within the project area. For the purposes of the investigation, target species included all US Fish and Wildlife Service Endangered, Threatened, Proposed, or Candidate plant species, as well as all Washington State Endangered, Threatened, Sensitive, and Review plant species. The prefield review identified 38 rare plant species that had potential for occurrence within the project area.

Three field surveys of the project area were performed to determine presence for the target species. The survey corridors included all lands within 50 meters of proposed project facilities (turbine strings, access roads, staging areas, etc.) as defined through July of 2002. The first field survey was performed in April of 2002, and covered specific habitats suitable for early season rare plant species. The second survey was performed in early June of 2002, and covered the entire project area. The final survey was conducted in July of 2002 and targeted only the riparian areas.

The field surveys did not locate any Federal or State Endangered, Threatened, Proposed, Candidate, or Sensitive plant species. However, four populations of one plant species on the Washington State 'Review' list were found within the project area. The species, white-margined knotweed (*Polygonum polygaloides* ssp. *kelloggii*), was found in vernal draws and low spots within the project area. An estimated 2,500 white-margined knotweed plants were found, with many more known to exist immediately adjacent to the current project area.

Because no direct project-related impacts to any federal or state Endangered, Threatened, Sensitive, Proposed, or Candidate plant species are anticipated, no species-specific mitigation measures are recommended at this time. Three general mitigation measures are proposed, however, to ameliorate potential indirect project-related impacts to rare plant species. These are: 1) performance of rare plant surveys in the potential impact corridors that were not covered in 2002; 2) implementation of a noxious weed control plan; and 3) avoidance of wildfire impacts during construction and operation.

The proposed project, as mitigated, is not expected to have direct impacts on any federal or state listed species. The limited direct impacts to white-margined knotweed (a Washington 'Review' species) are not expected to significantly impact the local population. In addition, the mitigated project is not expected to produce significant indirect impacts (resulting from noxious weed increases or fire frequency changes) to local populations of any plant species of concern.

1. INTRODUCTION

1.1 OVERVIEW

Zilkha Renewable Energy, LLC (Zilkha) is proposing to construct and operate a wind power facility which would be located to the northwest of Ellensburg, Washington. The project would consist of 100-150 turbines, arranged in strings along exposed ridges above the Yakima River. In addition, supporting facilities would be constructed, such as access roads, electrical lines, and an electrical substation. The proposed wind farm would be built primarily on private land, and tie into existing high voltage transmission lines that cross the site. As part of the permitting process, Zilkha is preparing an Environmental Impact Statement (EIS) to analyze potential impacts that the project may have on environmental resources. In support of the EIS, an investigation of rare plant resources has been undertaken to evaluate potential project effects on rare plant species. This investigation is ongoing, and the 2002 results are the subject of this report.

1.2 PROJECT DESCRIPTION

The proposed Kittitas Valley wind farm would consist of the installation, operation, and eventual decommissioning of 100-150 wind turbines and supporting facilities. The project is anticipated to produce up to 250 megawatts (MW), or 83 average megawatts (aMW). The power would be sold to one or more regional utilities for transmission to regional consumers. Zilkha has not yet selected the turbine vendor that would be used for the project, but anticipates using 1.5 MW units. The turbines are mounted on 50-75 meter (m) tubular towers, for a total height of 90-105 m (to the tip of the blade). The concrete tower foundations would be approximately 5-15 m square, and extend 6-15 m deep. Towers would be spaced approximately 100-150 m apart in the string.

The project's electrical system would consist of two key elements: (1) a collector system, which would collect energy at 690 volts from each wind turbine, increase it to 34.5 kilovolts (kV) by a pad-mounted transformer, and connect it to the project substation; and (2) the substation, which would transform energy from 34.5 kV to 230 kV. The collector system would consist of primarily underground 34.5 kV lines buried in one-meter-deep trenches. In limited areas, overhead transmission lines would be used. The substation would be located adjacent to existing Bonneville Power Administration (BPA) or Puget Sound Energy lines, and cover less than one hectare (ha).

Although county roads provide access to some of the project area, additional roads would be needed to construct and operate the project. Where possible, existing roads on private land would be upgraded to provide access to the turbine strings and supporting facilities. In other cases, it would be necessary to construct new graveled roads at the site. Access roads would permanently disturb an area approximately ten meters in width, with possible temporary disturbance extending another one to two meters on either side.

1.3 LOCATION

The proposed project is located in Kittitas County, Washington, approximately 14 kilometers (km) southeast of the town of Cle Elum, and 20 km northwest of the town of Ellensburg (Figure 1). The Yakima River flows to the south of the project area, passing within one kilometer of the southernmost turbine string. Interstate 90 roughly parallels the river to the south, and comes within two kilometers of the turbine strings. US Highway 97 runs through the middle of the project area, and State Highway 10 passes just south.

The project is contained in the following sections (Willamette Meridian):

- Township 19N, Range 17E, Sections 1-3, 7, 9-16, 21-23 and 27; and
- Township 20N, Range 17E, Section 34.

1.4 PHYSIOGRAPHY AND SOILS

The Kittitas Valley project area is located at the eastern base of the Cascade Mountain range, at the western edge of the Columbia Basin physiographic province (Franklin and Dyrness 1988). This lowland province, surrounded on all sides by mountain ranges and highlands, covers a vast area of eastern Washington, and extends south into Oregon. The province is characterized by moderate topography incised by a network of streams and rivers which empty into the centrally located Columbia River.

The project area extends over a nine by six kilometer portion of land which consists primarily of long north-south trending ridges. Between the ridges are ephemeral and perennial creeks that flow into the Yakima River, which is located just south of the project area. Slopes within the project area generally range from 5º to 20º, but can reach 40º or more in some of the stream canyons. Elevations in the project area range from 670 m above mean sea level along Highway 97, to 960 m at the top of String 'G'.

The soils on the project area ridgetops are primarily complexes of very shallow to moderately deep durixerolls that formed in alluvium and glacial drift over a duripan. Loess mixed with volcanic ash is typically present at the surface. Ridgetop soils in this portion of the project area (which includes the majority of the turbines) include the Lablue, Reelow, Sketter, and Reeser series (USDA 2002*a*).

1.5 CLIMATE

The Kittitas Valley project area is located at the western edge of the Columbia Basin physiographic province. This large province occurs within the rain shadow of the Cascade mountain range, and is characterized by semi-arid conditions, as well as a large range of annual temperatures indicative of a continental climate. However, the relatively close proximity of the Pacific Ocean and the dominant westerly winds of the region combine to moderate the continental influence (Franklin and Dyrness 1988).

The Cle Elum, WA weather station is located in the Yakima River valley, approximately 14 km northwest of the project area. The coldest average monthly temperatures at this station occur in January, with an average minimum of -6.7º Centigrade (C), and a maximum of 1.6º C. The warmest average monthly temperatures occur in July, when the minimum is 10.6º C and the maximum is 27.3º C. The average total annual precipitation for Cle Elum is 56.5 centimeters (cm). The wettest month is December with an average total monthly precipitation of 10.6 cm, while the driest month is July with an average total monthly precipitation of 0.89 cm. Snowfall typically occurs from November through March, with the heaviest average monthly snowfall of 62.2 cm occurring in January. The total annual average snowfall is 205 cm (WRCC 2000*a*).

In the other direction, the Ellensburg, WA weather station is located downstream from the project area along the Yakima River, approximately 20 km to the southwest. The coldest average monthly temperatures at Ellensburg also occur in January, and are similar to Cle Elum, with a minimum of -7.6º C, and a maximum of 1.2º C. Likewise the warmest average monthly temperatures in Ellensburg occur in July, when the minimum is 11.5º C and the maximum is 29.0º C. The average total annual precipitation at Ellensburg, is 22.6 cm, less than half that of Cle Elum. Similarly, Ellensburg's average annual snowfall (71.4 cm) is nearly one third that of Cle Elum (WRCC 2000*b*).

It should be noted that the highest point in the project area is over 400 m higher in elevation than the reporting station in both Ellensburg and Cle Elum. Therefore the project area would likely experience cooler temperatures, and perhaps receive slightly more precipitation, than is reported for either station.

1.6 VEGETATION

The project area is at the western edge of the Central Arid Steppe zone defined by the Washington State Gap Analysis (Cassidy *et al.* 1997). Their classifications for Eastern Washington steppe vegetation closely follow Daubenmire (1970). The Central Arid Steppe zone typically contains plant communities dominated by big sagebrush (*Artemisia tridentata*), bluebunch wheatgrass (*Pseudoroegnaria spicata*), and Sandberg's bluegrass (*Poa secunda*). In many areas of the zone, the introduced species cheatgrass (*Bromus tectorum*) is common due to past and present disturbance factors (Cassidy *et al.* 1997). The higher portions of the project area, border the Ponderosa Pine (*Pinus ponderosa*) zone.

The project area lies at the western edge of the big sagebrush/bluebunch wheatgrass vegetation zone as defined by Franklin and Dyrness (1988). They describe a number of other shrub species that may be present in the zone (all in small numbers), in addition to big sagebrush. These include: rabbitbrushes (*Chrysothamnus* spp. and *Ericameria* spp.), threetip sagebrush (*Artemisia tripartita*), and spiny hopsage (*Grayia spinosa*). The bluebunch wheatgrass is supplemented by variable amounts of needle-and-thread grass (*Hesperostipa comata*), Thurber's needlegrass (*Achnatherum thurberianum*), Cusick's bluegrass (*Poa cusickii*), and bottlebrush (*Elymus elymoides*). They also describe a low layer of plants consisting of Sandberg's bluegrass, cheatgrass, and flatspine stickseed (*Lappula occidentalis*).

Franklin and Dyrness (1988) also describe a number of plant associations that occur on lithosols (shallow soils) within the shrub-steppe region. These are particularly important for the purposes of this investigation, as lithosolic habitats occur commonly on the ridgetops within the project area. Daubenmire (1970) recognizes a variety of lithosolic plant associations. All are typically composed of a uniform layer of Sandberg's bluegrass, over a crust of mosses and lichens, with a low shrub layer above. The primary difference in these communities is in the composition of the shrub layer. Within the project area, the shrub layer on these lithosols is principally composed of several different buckwheat (*Eriogonum*) species.

The above descriptions of generalized vegetation zones and associations are based on climax communities, which typically develop over time in the absence of anthropogenic disturbance. Within the project area (as in most of the shrub-steppe region) many of the plant communities have been significantly modified due to numerous disturbance factors. This is especially true of the valley bottoms and side slopes. Cattle grazing, wildfire frequency changes, introduction of exotic plant species, ground disturbance from development activities, and a host of other factors have resulted in plant communities that are kept at an early- to mid-seral stage of development. Non-native aggressive invader species are common, and often dominate the community. Within the project area, the effects of these anthropogenic disturbances are common, although most of the communities are still dominated by native species. In many places, however, cheatgrass and bulbous bluegrass (*Poa bulbosa*) dominate the grass layer, and noxious weeds, such as diffuse knapweed (*Centaurea diffusa*), are common.

Several riparian areas associated with springs, seeps, and creeks are also present in the Kittitas Valley project area. These habitats are typically degraded from heavy cattle use, and much of the riparian vegetation has been removed. Common native riparian associates include chokecherry (*Prunus virginiana*), golden current (*Ribes aureum*), various rush species (*Juncus* spp.), various speedwell species (*Veronica* spp.), and yellow monkeyflower (*Mimulus guttatus*).

Table 1 describes the general cover types and habitat conditions found along the proposed turbine string ridgetops. In addition, a cover type map for the entire project area has been prepared and is on file at Zilkha's Portland offices.

Habitat quality within the project area ranges from 'poor' in many of the valley bottoms, to 'good' along some of the ridgetops and flats (see the legend at the bottom of Table 1 for a description of habitat quality rating criteria). Generally, the ridgetop habitats are in 'fair' to 'good' condition. More specifically, the ridgetop lithosols are typically in 'good' condition, containing a relatively intact vegetative structure and few non-native species. The deeper-soiled ridgetop habitats are generally in 'fair' condition, with certain areas dominated or co-dominated by non-native species in the grass layer.

The non-ridgetop habitats are generally more degraded from past disturbance than the ridgetop areas. This is especially true in the valley bottoms, where cattle grazing and road impacts have created large areas dominated by non-native invader species. Overall, the non-ridgetop habitats within the potential impact corridors are in 'fair' condition. However, habitat quality ranges from 'poor' in many of the valley bottoms, to 'good' on some of the canyon slopes.

1.7 LAND USE

The majority of lands within the project area are privately owned, although several parcels are owned and administered by the State of Washington Department of Natural Resources. Cattle grazing is the primary land use, although some rural homesite development has also taken place. The area is also used, on a much more limited basis, for recreational activities (primarily hunting). In addition, communications antenna clusters are located at several points within the project area. A high-voltage transmission line corridor crosses on a roughly east-west axis through the middle of the project area. This corridor contains four steel-tower 230kV electrical transmission lines. Additionally, there is a wood-pole 230kV transmission line that roughly parallels the four-line corridor, and a steel-tower 345 kV line running through the northern portion of the project area.

Several paved roads run through the project area. Highway 97 parallels the proposed turbine strings in the eastern portion of the project area, and Highway 10 runs along the Yakima River, just to the south of the project area. In addition, numerous smaller unpaved roads and jeep trails are located within the project area boundaries. These range from all-weather gravel roads, to two-track trails.

2. METHODS

2.1 STUDY AREA

For the purposes of the rare plant investigation, the study area included all lands within 50 m of the centerline of proposed facilities, as defined through July of 2002. This included proposed turbine strings, underground and overhead electrical lines, access roads, staging areas, and substation sites. In most cases, the resultant study corridors were 100 m wide, although in many areas, several project facilities are proposed to be located along side each other, resulting in a wider study corridor.

The study area was designed to take in all ground potentially disturbed by the project, however, changes to proposed facilities layouts occurred in late 2002, after the botanical field survey season. This resulted in several areas where facilities are currently proposed to be located outside of the surveyed corridor. These unsurveyed areas total approximately 12 km (7.7 miles) of corridor.

County-maintained roads were not analyzed, as these roads are not proposed for upgrade by the project. All other proposed new or existing access roads likely to be upgraded by the project were included in the rare plant study area.

Although for the purposes of impact analysis, only the study corridors were considered, a larger area was addressed during the prefield review in determining which rare plant species had potential for occurrence within the project area. This was necessary to analyze the project area in a regional context, and ensure that the target species list for the investigation was complete.

2.2 TARGET SPECIES

For the rare plant investigation, the target species included all plant taxa listed as 'Endangered', or 'Threatened' by the US Fish and Wildlife Service (USFWS). In addition, taxa that have been formally proposed, or are candidates for such federal listing, were also considered target species. Target species also included all plant taxa defined as 'Endangered', 'Threatened', 'Sensitive', 'Review', or 'Extirpated' by the Washington Natural Heritage Program (WNHP). Taxa meeting the above criteria were targeted by the investigation to determine their presence or absence within the study area. Determinations of status for rare plant species were based on the WNHP's list of tracked plant species (WNHP 2002*a*), and entries published in the US Federal Register.

2.3 PREFIELD REVIEW

As part of the investigation, a review of available literature and other sources was conducted to identify the rare plant species potentially found within the project area. As per Section 7(c)(1) of the US Endangered Species Act of 1973 (16 USC 1531, *et seq.*, as amended), a letter was sent to the USFWS requesting a list of federally Threatened, Endangered, or Proposed taxa which have potential to occur within the project area. In addition, the WNHP was contacted to obtain element occurrence records for any known rare plant populations in the vicinity. To supplement the information provided by the above agencies, a number of other sources were consulted. These sources provided additional information on the potential rare plant species for the project, including critical information such as habitat preferences, morphological characteristics, phenologic development timelines, and species ranges. Sources included: taxonomic keys and species guides (Flora ID Northwest 2001, USFWS 2001, WNHP 1999, Hickman 1993, Hitchcock and Cronquist 1973, Hitchcock *et al.* 1964); online databases of common and rare plant species (ECCI 2002, USDA 2002*b*); species lists from nearby areas (PNL 2000); environmental documents from other energy projects in the area (BPA 2002, USFS 1998, Dames and Moore Consultants 1998*a,b*); and Natural Resources Conservation Service (NRCS) soils data (USDA 2002*a*). Agency, university, and private botanists with local knowledge of the region were also contacted (Beck 2001, Downs 2001, Simmons 2001).

Using data collected during the prefield review, a list of rare plant species potentially occurring in the project area was compiled. Habitat preferences and identification periods were derived from the literature for each potential species. Using this information, along with topographic maps of the project area, a field survey plan was developed to guide the timing and intensity of the field surveys.

2.4 FIELD INVESTIGATION

All field work was performed by trained botanists who have experience performing rare plant surveys in the region. Appendix 1 contains a summary of each investigator's education and experience.

Immediately prior to the first rare plant survey of the site in April, the surveyors visited a known population of Hoover's tauschia (*Tauschia hooveri*) near Fort Simcoe south of Yakima. This

visit served to confirm assumptions regarding identification characteristics for the species, and verified the timing of the early-season surveys.

Three pedestrian field surveys were performed during the 2002 growing season to locate rare plant species within the study area. The first of these took place on April 25 and 26, and was designed to located populations of Hoover's tauschia and other early-blooming species. Only habitats capable of supporting these early-blooming target species were searched (primarily the shallow-soiled ridgetops and talus slopes). However, because these habitats are common in the area, the majority of the study area was surveyed. Two botanists visually surveyed most of the ridgetop habitats within the study area at a level sufficient to determine the presence of the target early-season species. Where road access was available and no suitable habitat existed, the survey was cursory and took place from a vehicle. Where suitable habitat was found, the survey was accomplished by performing meander pedestrian transects, zig-zagging back and forth across the survey corridor.

The second rare plant survey was performed from June 3-7, 2002. This survey was designed to locate those target species that are identifiable during mid- to late-spring (this includes the majority of the target rare plant species). The June survey was conducted by three field botanists, who surveyed all ground within the study area using an 'intuitive controlled' survey pattern. The 'intuitive controlled' pattern is a variable intensity survey protocol designed to cover all ground within a study area at a level sufficient to locate all occurrences of the target species. The botanists, primarily working singly, walked each survey corridor, crossing back and forth from one edge of the corridor to the other in a zig-zag pattern. The intensity of the pattern, and the speed at which the surveyors walked, was variable, and depended on the structural complexity of the habitat, the visibility of the target species, and the probability of species occurrence in a given area. In some high probability, low visibility habitats, a tight grid pattern was walked. Care was taken to thoroughly search all unique features and any high probability habitats encountered.

The third survey took place from July 17 through July 22, 2002 and was designed to locate certain rare plant species not identifiable in the spring. These were all species associated with riparian habitats, and the summer survey focused on the springs, seeps, and creeks of the project area. This survey used a 'targeted' survey pattern to search only the riparian habitats, which had been identified previously during the spring field work. Two botanists traveled, either on foot or by vehicle, to each riparian habitat, intensively searched the area on foot, and then continued on to the next identified riparian habitat.

During all surveys, the investigators kept a list of all vascular plants encountered, and made informal collections of unknown species for later identification in the laboratory. *Vascular Plants of the Pacific Northwest* (Hitchcock *et al*. 1964) and *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973) were used as the primary authorities for vascular plant species identification. Updated taxonomy was referenced in the NRCS PLANTS database, (which also serves as the source for the common plant names used in this document) (USDA 2002*b*). Notes were also recorded regarding plant associations, land use patterns, unusual habitats, etc.

When target plant populations were found, data were collected regarding population size, location, associated habitat, and a number of other parameters. A standard rare plant site form was used to collect the information (Appendix 2). Photographs of the population (both close-ups

and general habitat shots) were taken using a Nikon® 950 digital camera. The location of the population was mapped on 7.5" US Geological Survey topographic quadrangle sheets. Garmin® 12-Series Geographic Positioning System (GPS) receivers were used to record the perimeter of the population for later entry into the project Geographic Information System (GIS). In the project area, these GPS units typically self-reported an estimated positional error of seven meters or less.

The entire extent of each population was mapped, where feasible. However, where the populations were extensive and extended well beyond the edge of the study corridors, mapping the entire extent was not undertaken. In these cases, only the part of the population that occurred within the study corridor was mapped.

3. RESULTS

3.1 PREFIELD REVIEW

The USFWS Section 7 response letter listed one federally threatened plant species with potential for occurrence in the project area: *Spiranthes diluvialis* (Ute ladies'-tresses). No other plant species of concern to the USFWS were listed in the letter.

The WNHP reported one element occurrence record for a tracked plant species in the project vicinity (WNHP 2002*b*). This species occurrence, Suksdorf's monkey-flower (*Mimulus suksdorfii*), was reported from Township 19N Range 16E Section 1, which is just north of the project area. The locational information for this population is not precise, and the last reported observation was in 1980. It should be noted that, although the section containing the population is immediately adjacent to the project area, the habitat in that section is primarily forested, as opposed to the project area, which is non-forested.

The final list of rare plant species thought to have potential for occurrence within the Kittitas Valley Wind Power project area is presented in Table 2. It includes all of the species discussed in this section above, as well as a number of others which were suggested by additional contacts and references consulted during the prefield review. Although rare plant species other than those listed in Table 2 were not thought to have potential for occurrence within the project area, all rare plant species known or suspected to occur in Washington were considered during the field survey. The species listed in Table 2, however, received the most focus during the investigation.

3.2 FIELD INVESTIGATION

The field surveys did not locate any USFWS Endangered, Threatened, Proposed, or Candidate plant species. Marginal potential habitat was found for one federally listed species, Ute ladies'-tresses (*Spiranthes diluvialis*), in several of the project area riparian zones. However, the project area is west of the species' known range, and the habitat at these sites was degraded due to past

disturbance. Both these factors greatly reduced the potential for occurrence of Ute ladies'-tresses.

Marginal potential habitat was also found for one federal Candidate species; basalt daisy (*Erigeron piperianus*). Although basalt daisy is typically restricted to the extensive cliffs along the Yakima River and Selah Creek, all cliffs within the project area were searched intensively for the presence of the species with negative results.

Marginal potential habitat was also found within the study area for a number of federal 'Species of Concern'. These include Columbia milkvetch (*Astragalus columbianus*), Hoover's desert-parsley (*Lomatium tuberosum*), least phacelia (*Phacelia minutissima*), Seely's silene (*Silene seelyi*), and Hoover's tauschia. In all cases, where potential habitat was found for these species, the area was searched carefully, with negative results.

Likewise, the field surveys did not locate any plants listed as Endangered, Threatened, or Sensitive by the State of Washington. Potential habitat, however, was found for a number of these species throughout the project area. These habitats were searched thoroughly for the presence of the target species, but none was found.

Four populations of one plant species on the Washington State 'Review' list were found within, or immediately adjacent to, the project area. The species, white-margined knotweed (*Polygonum polygaloides* ssp. *kelloggii*), was found in the project area in vernally moist draws and swales (Figures 3 & 4). An estimated 2,500 white-margined knotweed plants were found in these four populations, and totaled over 2.5 ha in gross population area. Much of the suitable habitat present (vernally moist areas) was found to contain the species. Most of the knotweed plants were in full flower, or beginning to fruit at the time of the second survey.

It should also be noted that during the surveys of the original project area, which included a large portion of proposed project area west of Swauk Creek that was subsequently dropped from consideration, eleven populations of white-margined knotweed were found (including the four described above). Several of the populations were extensive and contained tens of thousands of plants within the survey corridor. These populations extended out of the survey corridor for an unknown distance, so estimates of total individuals and population size are likely conservative. An estimated 67,600 white-margined knotweed plants were found within the study corridors (with many more extending outside the corridors). Gross population areas ranged from 0.01 ha to 2 ha within the study corridors, and totaled over 14 ha for all eleven populations.

Locations of the white-margin knotweed populations are shown in Figure 2. A complete list of all plant species encountered during the surveys is included in Appendix 3. Typical habitat encountered in the project area is shown in Figures 5 & 6.

4. DISCUSSION

4.1 SURVEY TIMING AND COVERAGE

The combination of three surveys targeting species identifiable in the early spring, late spring, and summer was thought to be sufficient to identify all of the target species within the areas surveyed. As is common during the permitting process for most large construction projects, however, late-season changes to proposed facilities layouts occurred for the Kittitas Valley project. This resulted in approximately 12 km (7.7 miles) of the current proposed impact corridors that have not yet been surveyed for rare plants. It is unlikely, though, that significant rare plant populations exist within these unsurveyed corridors. In all cases, the habitat in the unsurveyed corridors is similar to that encountered in the surveyed areas. Given that no target plant species were found in the adjacent surveyed corridors (other than white-margined knotweed), the potential for other rare plant populations in these areas is thought to be limited.

In addition, several riparian areas within the survey corridors contained marginal habitat for Ute ladies'-tresses, a late-season rare orchid which blooms from late July through September. When these areas were surveyed in the latter half of July, no orchids of any species were found. Late August surveys of these small areas were not conducted for the following reasons:

1. the project area is well west of the species' known range;
2. the riparian areas contained only marginal potential habitat for the species; and
3. no orchids of any kind were found during the July survey.

It was felt that these three factors indicated that no Ute ladies'-tresses individuals exist within the project area.

4.2 TARGET PLANT SPECIES WITHIN THE PROJECT AREA

Only one target plant species is known to exist within the project area; white margined knotweed. It is a small, annual plant in the buckwheat (Polygonaceae) family, which typically grows in meadows and vernal pools, up to dry subalpine slopes (Hitchcock and Cronquist 1964). It ranges from British Columbia southward on the east side of the Cascade Crest to Northern California, extending east to Montana, Wyoming, Colorado, and Arizona. The taxon was originally considered a separate species (*Polygonum kelloggii*), but the current consensus treats it as a subspecies of *P. polygaloides*.

White-margined knotweed is currently a Washington State 'Review 1' species, indicating that, within the state, the species is a, "[p]lant taxon of potential concern, [but is] in need of additional field work before a status can be assigned" (WNHP 2002*c*). The Review designation carries no legal requirement for protection, however, WNHP personnel are interested in tracking occurrences of Review species to aid in the assignment of status. White-margined knotweed is not currently regarded as Endangered, Threatened, or 'Species of Concern' by the USFWS.

The four populations found within the project area are all located in vernally wet swales, seeps, and draws. These habitats are well represented within the project area, and much of the suitable habitat searched was found to contain the species. In addition, a large amount of suitable habitat exists nearby, adjacent to the survey corridors. Although areas outside of the corridors were typically not surveyed, it is reasonable to assume that much of this suitable habitat also contains white-margined knotweed.

4.3 POTENTIAL PROJECT IMPACTS TO TARGET PLANT SPECIES

Due to the absence of known populations within the project area as surveyed to date, no project-related impacts are anticipated to any federally Endangered, Threatened, Proposed, or Candidate plant species. Likewise, no project-related impacts are predicted for any Washington State Endangered, Threatened, or Sensitive plant species.

Limited impacts are anticipated, however, to one species on the Washington State Review list; white-margined knotweed. Ground disturbance related to construction and operation of the proposed project could cause direct adverse impacts to knotweed individuals if they are located within the impact footprint. However, due to the large size of many of the populations, and the high likelihood that many more populations occur in the area adjacent to the impact corridors, the project is not expected to significantly impact the species' viability in the project area. Of the estimated 2,500 knotweed individuals in the study corridor, less than 10% are expected to be directly impacted by the project. This level of direct impact is not anticipated to jeopardize the continued existence of the local population, or lead to the need for state or federal listing.

Furthermore, in the project vicinity, eleven populations of white-margined knotweed are known, totaling more than 67,500 individuals. Within this larger area the project is expected to impact less than 0.5% of these individuals.

In addition to direct impacts from ground disturbing activities, the project also has the potential to impact white-margined knotweed indirectly if the project leads to the degradation of habitat in the area through the introduction and spread of noxious weeds. Although little is known about how white-margined knotweed responds to competition from non-native species, it is safest to assume that significant increases in noxious weeds in the area would be detrimental to the species. At the present time, the habitat where white-margined knotweed is found is relatively intact. Native species predominate at the sites, although some noxious weeds are present. If the project lead to the degradation of these vernally wet communities by increasing noxious weed densities, it is likely that some level of adverse impact to the knotweed populations would occur.

4.4 RECOMMENDED MITIGATION MEASURES

Because no direct project-related impacts to any federal or state Endangered, Threatened, Sensitive, Proposed, or Candidate plant species are anticipated, no species-specific mitigation measures are proposed at this time. The limited impacts to one, locally common, Washington State Review species (white-margined knotweed) are not expected to significantly impact the species or jeopardize the continued existence of the local population. Therefore, no specific

mitigation measures are proposed to ameliorate impacts to this species. However, several measures are recommended to mitigate possible indirect effects to white-margined knotweed, and to other species of concern (if any) potentially in the vicinity, outside of the survey corridors.

1. As is typical with projects that are evolving during and after the period that field work occurs, portions of the currently proposed project lie outside the corridors that were surveyed during 2002. Based on the survey work that was completed, it is unlikely that the unsurveyed areas contain populations of rare plants. However, surveys will be conducted at the appropriate time during the spring of 2003 to confirm that no such populations are present in areas not surveyed in 2002.

2. Because noxious weeds can have numerous detrimental effects on rare plant populations, measures should be implemented to control the introduction and spread of undesirable plants during and after construction. Noxious weed control measures include: cleaning construction vehicles prior to bringing them into the project area from outside areas; quickly revegetating habitats temporarily disturbed during construction; and actively controlling noxious weeds that have established themselves as a result of the project. Prior to construction, a noxious weed control plan should be developed, and the plan should be implemented over the life of the project.

3. Indirect project-related impacts to plant species of concern may also occur as a result of changes in fire frequency patterns in the area. Project access roads can act as fire breaks, thereby decreasing the size of a wildfire. Likewise, the project roads may allow fire crews to access small fires faster, and more effectively fight larger fires. Conversely, project operation and maintenance activities have the potential to ignite wildfires if precautions are not taken. Because it is not clear if these effects would have a positive or negative effect on project area rare plants, the most prudent course of action would be to implement measures to maintain existing fire frequency patterns. While certain factors are out of the control of the proponent, steps can be taken to minimize the risk of wildfire both during the construction and operation phases of the project. Prior to construction, a comprehensive fire control plan should be developed, and implemented project-wide over the life of the project. The fire control plan should take into account the dry nature of the region, and address risks on a seasonal basis.

4.5 SIGNIFICANCE OF IMPACTS

The proposed project, as mitigated, is not expected to have direct impacts on any federal or state listed species. The limited direct impacts to white-margined knotweed (a Washington 'Review' species) are not expected to significantly impact the local population. In addition, the mitigated project is not expected to produce significant indirect impacts (resulting from noxious weed increases or fire frequency changes) to local populations of any plant species of concern.

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TABLES

Table 1: Summary of Habitats Associated with the Proposed Turbine Strings of the Kittitas Valley Wind Power Project

Facility	Habitat Description[1]
Turbine String 'A'	Shallow-soiled lithosol alternates with deeper-soiled shrub-steppe habitat. Habitat quality is generally good: native species dominate the shallow soils, and native shrubs and forbs combine with native and non-native grasses to dominate the deeper soils.
Turbine String 'B'	The north half of this string is located on a mosaic of shallow-soiled rocky areas and deeper-soiled shrub-steppe habitat. Habitat quality is generally good: native species dominate the shallow soils, and native shrubs and forbs combine with native and non-native grasses to dominate the deeper soils. Various limited ground and vegetation disturbance has occurred here from recreational activities (gun club). One noxious weed population was observed along a jeep trail which runs along this section of the proposed string. The south half of this string contains the same mosaic of shallow and deeper soils, however, a fire within the last 10 years has removed most of the shrubs, and the habitat now consists of a mix of native and non-native grasses and forbs, with widely scattered small shrubs. Habitat quality is generally fair. Weedy species are more common in the deeper-soiled areas, and several populations of noxious weeds are present.
Turbine String 'C'	Shallow-soiled grassland and lithosol alternates with deeper-soiled shrub-steppe habitat. Habitat quality is generally good: native species dominate the shallow soils, and native shrubs and forbs combine with native and non-native grasses to dominate the deeper soils.
Turbine String 'D'	The north half of this string is similar to String C with alternating lithosols and deeper-soiled habitats in generally good condition. The south half of this string is a continuation of the same deeper-soiled shrub-steppe habitat.
Turbine String 'E'	This string consists mainly of deeper-soiled shrub-steppe habitat, with inclusions of shallow-soiled lithosol in the north half, and small patches of non-native species throughout. Much of the habitat in the string is in fair to good condition (i.e., dominated by native shrubs and forbs, and a mix of native and non-native grasses), although some areas have been burned recently, and one noxious weed population is present along the jeep trail, which runs the length of the ridgetop.
Turbine String 'F'	This string contains mainly shallow-soiled lithosol, with some areas of deeper-soiled shrub-steppe in the south half. Habitat quality is generally good: native species dominate the shallow soils, and native shrubs and forbs combine with native and non-native grasses to dominate the deeper soils. However, a large gravel pit operation at the north end of this string has completely displaced the lithosol habitat in that area. A rough jeep trail runs the length of this proposed string.

Facility	Habitat Description[1]
Turbine String 'G'	This string consists almost entirely of shallow-soiled lithosol habitat, with small areas of deeper-soiled shrub-steppe and deciduous thicket habitats in the north half and at the south end. Habitat quality is generally good: native species dominate the shallow soils, and native shrubs and forbs combine with native and non-native grasses to dominate the deeper soils. Two noxious weed populations were observed, one along a road at the north end of the string, and another in a small draw near the south end of the string. A well-developed jeep trail is present along the north half of the corridor.
Turbine String 'H"	This string also consists almost entirely of shallow-soiled lithosol habitat, with areas of deeper-soiled shrub-steppe habitat at the north end, midpoint, and the south end. Habitat quality is generally good: native species dominate the shallow soils, and native shrubs and forbs combine with native and non-native grasses to dominate the deeper soils. However, there are two areas of major soil disturbance (blading) near the midpoint of the string, where the lithosol species have been largely replaced by non-native forbs and grasses. In addition, three populations of noxious weeds were observed along this string, near roads. Finally, one portion of the lithosol in the south end shows signs of heavy livestock use, although native plants continue to dominate. A well-developed two-lane gravel access road runs the length of this ridgetop, providing access for local landowners.
Turbine String 'I'	This string consists primarily of shallow-soiled lithosol habitat, although portions of the middle section, and all of the southern tip, contain deeper-soiled shrub-steppe habitat, as well as small inclusions of grassland. Habitat quality is generally good: native species dominate the shallow soils, and native shrubs and forbs combine with native and non-native grasses to dominate the deeper soils. However, the areas of grassland are only fair quality, dominated by non-native grasses and forbs, and one noxious weed population was observed at the south end of the string.
Turbine String 'J'	The south half of the string is located mainly on deeper-soiled shrub-steppe habitat, with one area of shallow-soiled lithosol. Habitat quality is generally good: native species dominate the shallow soils, and native shrubs and forbs combine with native and non-native grasses to dominate the deeper soils. However, the south tip of the string consists of fair quality, shallow-soiled grassland dominated by non-native grasses and forbs. Two populations of noxious weeds were observed in this half of the string. The north half of this string contains the same general pattern of shallow and deeper soils, however, a fire within the last 5-10 years removed most of the shrubs, and the deeper-soiled habitat now consists of a mix of native and non-native grasses and forbs, with widely scattered small shrubs. Although overall habitat quality is fair, several small inclusions of generally good quality lithosol are present in this half of the string.

Facility	Habitat Description[1]
Intervening Facilities (access roads, electric lines, O&M facilities, etc., located between turbine strings)	Over 40% of the potential project impact corridor is located off of the ridgetops, between the turbine strings. Primarily, these are connecting facilities such as access roads and electrical lines, but include O&M areas also. These non-ridgetop habitats are typically deeper-soiled, and are generally more degraded from past disturbance than the ridgetop habitats. This is especially true in the valley bottoms, where cattle grazing and road impacts have created large areas dominated by non-native invader species. Overall, the non-ridgetop habitats within the impact corridors are in fair condition. However, habitat quality ranges from poor in many of the valley bottoms, to good on some of the canyon slopes.

Legend: Habitat Description[1]: In the habitat descriptions, ratings of habitat quality are based on general observed patterns of plant species diversity, native versus non-native ratios, and overall vegetative structure. The habitat ratings are qualitative only, based on general visual observations. Quantitative habitat quality information was not collected. The following categories were used: 'Excellent' (high species diversity with negligible amounts of non-native weedy species, along with well developed native vegetative structure); 'Good' (moderate to high species diversity dominated by native plants, with significant inclusions of non-native species in certain areas, and fair to well-developed native plant structure); 'Fair' (moderate diversity with non-native species dominance or co-dominance in some or all layers, and fair native structure); and 'Poor' (low species diversity, dominated by non-native, weedy invaders in some or all layers, and poor native plant structure.

Table 2: Rare Plant Species with Potential for Occurrence in the Kittitas Valley Wind Power Project Area

Name	Status[1]	Typical Habitat	ID Period[2]
Agoseris elata **tall agoseris**	S	Meadows, open woods, and exposed rocky ridgetops	June-August
Anemone nuttalliana **Pasque flower**	S	Prairies to mountain slopes, mostly on well-drained soil	May-August
Astragalus arrectus **Palouse milk-vetch**	S	Grassy hillsides, sagebrush flats, river bluffs, and openings in open ponderosa pine and Douglas fir forests	April-July
Astragalus columbianus **Columbia milk-vetch**	LT (SC)	Sagebrush-steppe	March-June
Astragalus misellus var. *pauper* **Pauper milk-vetch**	S	Open ridgetops and slopes	April-mid June
Camissonia pygmaea **dwarf evening-primrose**	LT	Unstable soil or gravel in steep talus, dry washes, banks and roadcuts	June-August
Camissonia scapoidea **naked-stemmed evening-primrose**	S	Sagebrush desert, mostly in sandy, gravelly areas	May-July
Carex buxbaumii **Buxbaum's sedge**	S	Peat bogs, marshes, wet meadows, and other wet places	June-August
Carex comosa **bristly sedge**	S	Marshes, lake shores, and wet meadows	May-July
Carex hystricina **porcupine sedge**	S	Wet ground near creeks, seeps, and springs	May-June
Collomia macrocalyx **bristle-flowered collomia**	S	Dry, open habitats	late May-early June
Corydalis aurea **golden corydalis**	R1	Varied habitats, moist to dry and well-drained soil	May-July
Cryptantha leucophaea **gray cryptantha**	S (SC)	Unstable sandy substrate along the Columbia River	May-June
Cryptantha rostellata **beaked cryptantha**	S	Very dry microsites within sagebrush-steppe	late April-mid June
Cyperus bipartitus **shining flatsedge**	S	Streambanks and other wet, low places in valleys and lowlands	August-September
Cypripedium fasciculatum **clustered lady's slipper**	S (SC)	Mid- to late seral Douglas fir or ponderosa pine forest	early May-mid June
Delphinium viridescens **Wenatchee larkspur**	LT (SC)	Moist meadows, moist microsites in open coniferous forest, springs, seeps, and riparian areas	July
Eatonella nivea **white eatonella**	LT	Dry, sandy, or volcanic areas within sagebrush-steppe	May

Name	Status[1]	Typical Habitat	ID Period[2]
Erigeron basalticus **basalt daisy**	LT (C)	Crevices in basalt cliffs on canyon walls	May-June
Erigeron piperianus **Piper's daisy**	S	Dry, open places, often with sagebrush	May-June
Hackelia hispida var. *disjuncta* **sagebrush stickseed**	S	Rocky talus	May-June
Iliamna longisepala **longsepal globemallow**	S	Sagebrush-steppe and open ponderosa pine and Douglas fir forest	June-August
Lomatium tuberosum **Hoover's desert-parsley**	LT (SC)	Loose talus and drainage channels of open ridgetops within sagebrush-steppe	March-early April
Mimulus suksdorfii **Suksdorf's monkey-flower**	S	Open, moist to rather dry places within sagebrush-steppe	mid April-July
Nicotiana attenuata **coyote tobacco**	S	Dry, sandy bottom lands, dry rocky washes, and other dry open places	June-September
Oenothera cespitosa ssp. *cespitosa* **cespitose evening-primrose**	S	Open sites on talus or other rocky slopes, roadcuts, and the Columbia River terrace	late April-mid June
Ophioglossum pusillum **adder's-tongue**	LT	Terrestrial in pastures, old fields, roadside ditches, and flood plain woods, in seasonally wet soil	June-September
Pediocactus simpsonii var. *robustior* **hedgehog cactus**	R1	Desert valleys and low mountains	May-July
Pellaea breweri **Brewer's cliff-brake**	S	Rock crevices, ledges, talus slopes, and open rocky soil	April-August
Penstemon eriantherus var. *whitedii* **fuzzytongue penstemon**	R1	Dry open places	May-July
Phacelia minutissima **least phacelia**	S (SC)	Moist to fairly dry open places	July
Polygonum polygaloides ssp. *kelloggii* **white-margin knotweed**	R1	Meadows and vernal pools	June-August
Pyrrocoma hirta var. *sonchifolia* **sticky goldenweed**	R1	Meadows and open or sparsely wooded slopes	July-August
Sidalcea oregana var. *calva* **Oregon checker-mallow**	LE (PE)	Moist meadows, open coniferous stands, and along the edge of shrub and hardwood thickets	mid June-late July
Silene seelyi **Seely's silene**	LT (SC)	Shaded crevices in ultramafic to basaltic cliffs and rock outcrops, and among boulders in talus	May-August
Spiranthes porrifolia **western ladies-tresses**	S	Wet meadows, streams, bogs, and seepage slopes	May-August

Name	Status[1]	Typical Habitat	ID Period[2]
Tauschia hooveri **Hoover's tauschia**	LT (SC)	basalt lithosols within sagebrush-steppe	March-mid April

Status[1]: Washington State Status (with USFWS status in parenthesis if applicable)

E: State Endangered. Taxa that are in danger of becoming extinct in Washington within the near future if factors contributing to their decline continue.

T: State Threatened. Taxa that are likely to become Endangered in Washington within the near future if factors contributing to their decline continue.

S: State Sensitive. Taxa that are vulnerable or declining, and could become Endangered or Threatened in Washington without active management or removal of threats.

R1: State Review Group 1: Taxa for which there is insufficient data to support listing in Washington as Threatened, Endangered, or Sensitive.

R2: State Review Group 2: Taxa for which taxonomic questions exist.

X: State Extirpated. Taxa possibly extirpated from Washington.

(LE): Federal Listed Endangered: Taxa in danger of Extinction throughout all or a significant portion of their range.

(LT): Federal Listed Threatened: Taxa likely to be classified as Endangered within the foreseeable future throughout all or a significant portion of their range.

(PE): Federal Proposed Endangered: Taxa proposed to be listed as Endangered (formal rulemaking in progress).

(C): Federal Candidate: Taxa that are candidates for formal listing as Endangered or Threatened.

(SC): Federal Species of Concern: Available information supports tracking the status and threats to these species because of one or more of the following factors: negative population trends have been documented; habitat is declining or threats to the habitat are known; subpopulations or closely related taxa have been documented to be declining; competition or genetic implications from introduction/stocking of exotic species; identified as a species of concern by agencies or professional societies; or in combination with any of the other criteria, information is needed on status or threats to these species.

ID Period[2]: The normal peak period during which the species is identifiable in the field.

FIGURES

Figure 1: Kittitas Valley Wind Power Project Area

A — Proposed Turbine Locations and String Names

Operations & Maintenance Sites

Proposed Access Roads

Proposed Electric Lines

Contour Interval 40 ft.

Scale 1:27000

1 0 1 2 3 Kilometers

EAGLE CAP CONSULTING

January 6, 2003

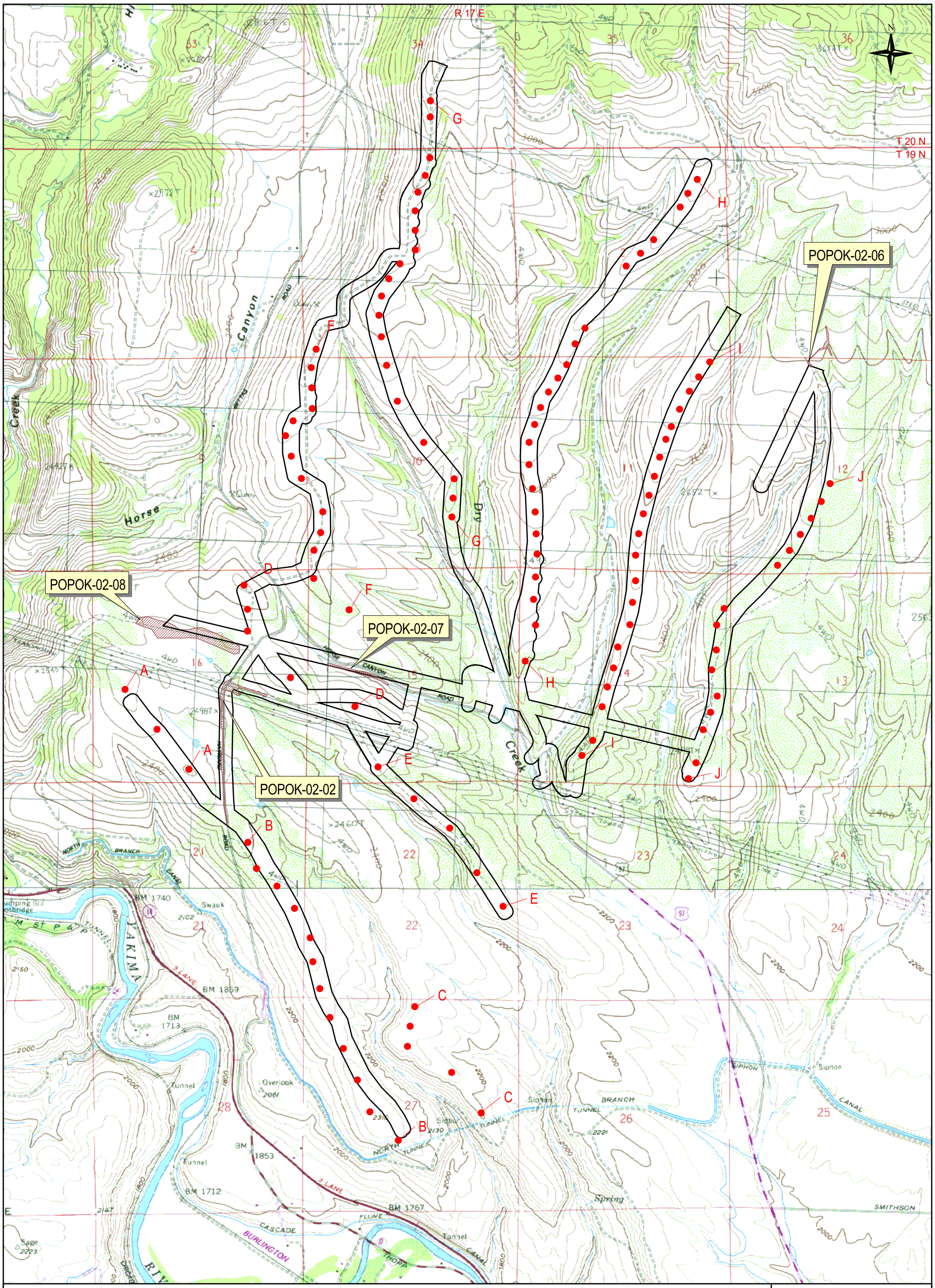

Figure 2: Rare Plant Populations

White-Margined Knotweed Populations

2002 Survey Corridor

A — Proposed Turbine Locations and String Names

Contour Interval 40 ft.

Scale 1:27000

1 0 1 2 3 Kilometers

EAGLE CAP CONSULTING

January 6, 2003

Figure 3: Photo of White-Margined Knotweed

Figure 4: Photo of White-Margined Knotweed Habitat

Figure 5: Photo of Habitat Near Bottom of String 'G'

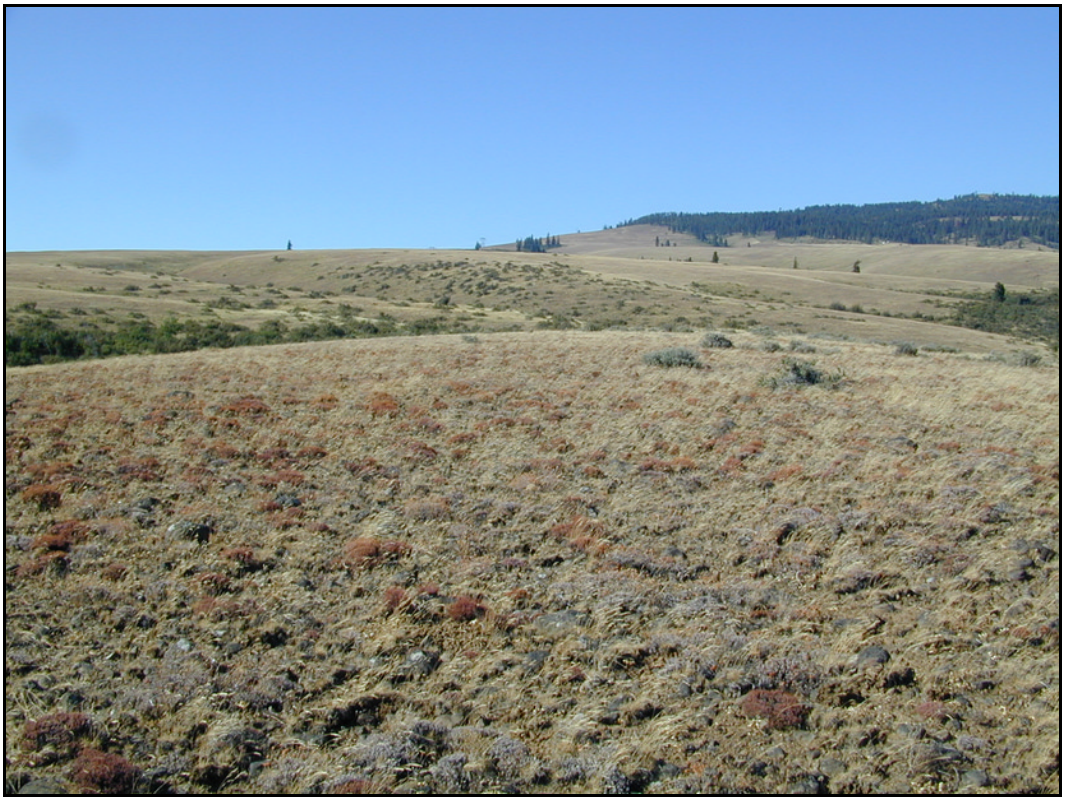

Figure 6: Photo of Habitat Along String 'A'

APPENDICES

Appendix 1: Investigator Qualifications

Suki Cupp – Project Manager (Botanical Studies): Ms. Cupp holds a Bachelor of Science degree in Botany, a Master of Landscape Architecture degree, and a Master of Forest Resources degree. She has a strong background in ecosystems management and has taught college-level biology and botany courses. Ms. Cupp has sixteen years experience performing and documenting resource inventories, rare plant surveys, wetland mitigation and monitoring projects, and feasibility studies. She has worked closely with various federal and state agencies, including the US Army Corps of Engineers, Washington Department of Ecology, and the Oregon Division of State Lands. For the Kittitas Valley project, Ms. Cupp was the project manager for the botanical studies portion of the permitting project. She coordinated the administrative and agency contact tasks of the studies, and served as a primary botanical surveyor for the field investigations.

Randall Krichbaum – Principal Investigator (Botanical Studies): Mr. Krichbaum holds a Bachelor of Science degree in Zoology, and a Master of Science degree in Resources and the Environment. His graduate work investigated the methods used in rare plant studies conducted during the impact assessment process. In 1991 he co-founded Eagle Cap Consulting Inc., an environmental consulting firm that specializes in impact assessment studies for private and public development projects. In his twenty years of experience, Mr. Krichbaum has directed numerous environmental investigations for major energy projects. He has served as the botanical principal investigator on six wind power projects in the Columbia Basin over the past six years. For the Kittitas Valley project, Mr. Krichbaum coordinated the scientific and technical aspects of the rare plant investigation and vegetation mapping, and served as a primary surveyor for all botanical field work.

Margaret Horvath – Botanist/GIS Specialist: Ms. Horvath has a Bachelor of Science degree in Geography, focusing on the physical and biological aspects of the discipline. In addition, she has completed post-graduate training in GIS database management. She co-founded Eagle Cap Consulting Inc. in 1991, and has worked on most of the firm's projects in her capacity as a field botanist and GIS specialist. Ms. Horvath has completed numerous rare plant field surveys throughout the Northwest for a number of public and private development projects, including six wind power projects in the Columbia Basin. In addition, she also manages the firm's GIS services, and produces most of the project maps used in the field and in the firm's technical reports. For the Kittitas Valley project, Ms. Horvath was a primary field survey crew member, and coordinated much of the data gathered during the prefield and field portions of the project. In addition, she maintained the project GIS database, and produced the botanical resources maps for the rare plant task and vegetation mapping task.

Appendix 2: Sample Rare Plant Data Form

Eagle Cap Consulting Rare Plant Observation Form

Project: _____

Sci. Name: _____ **Spp. Code:** _____ **Site Number:** _____

Recorder(s): _____ **Phone:** _____ **Date:** _____

Address: _____

Quad Name: _____ **Landowner:** _____

County: _____ **UTM Coord.:** _____**N** _____**E**

T: _____ **R:** _____ **S:** _____ _____ **¼ of the** _____ **¼; T:** _____ **R:** _____ **S:** _____ _____**¼ of the** _____**¼**

Directions:

New Site? ☐ **EO#:** _____ **Min. Elevation (m):** _____ **Max. Elevation (m):** _____

Total # in pop.: _____**actual** _____**estimated** **Survey Intensity:** _____

What was counted? ☐**Genets (genetically distinct individuals) or** ☐**Ramets (stems of a clonal plant)**

Phenology (% of pop.): _____**Vegetative** _____**Flower** _____**Fruit** _____**Dormant**

Pop. age class (%): _____**Seedlings** _____**Immature** _____**Mature** _____**Senescent** _____**Unknown**

Gross pop. area _____**m²** **Net area:** _____**m²** **Slope (deg.):** _____ **Aspect (deg.):** _____

Habitat:

Percent Cover: _____**Trees** _____**Shrubs** _____**Forbs** _____**Grasses** _____**Litter** _____**Bare**

Abundant Species			Common Species			Uncommon Species		

Threats: _____

How was ID made? _____

Other knowledgeable individuals: _____

Photo Roll and No.: _____ **Collection ID:** _____ **Herbarium:** _____

Comments:

Appendix 3: Vascular Plant Species Found within the Kittitas Valley Wind Power Project Area

Vascular Plant Species
Kittitas Valley Wind Power Project
Survey Date(s): April 26 through July 22, 2002

Botanical nomenclature follows the USDA Natural Resources Conservation Service PLANTS Database (USDA 2002)
** = introduced plants*

Family	Scientific Name	Common Name
ACERACEAE	*Acer glabrum*	Rocky Mountain maple
ALISMATACEAE	*Alisma triviale*	northern water plantain
AMARANTHACEAE	*Amaranthus blitoides*	mat amaranth
APIACEAE	*Cicuta douglasii*	western water-hemlock
	Heracleum maximum	cow-parsnip
	Lomatium canbyi	Canby's desert-parsley
	Lomatium dissectum	fern-leaved lomatium
	Lomatium farinosum var. hambleniae	Hamblen's lomatium
	Lomatium geyeri	Geyer's lomatium
	Lomatium gormanii	Gorman's desert-parsley
	Lomatium macrocarpum	big-fruited lomatium
	Lomatium nudicaule	pestle parsnip
	Lomatium triternatum	nine-leaf lomatium
	Osmorhiza berteroi	mountain sweet-root
	Osmorhiza occidentalis	western sweet-root
	Osmorhiza sp.	sweet-root
	Perideridia gairdneri ssp. borealis	Gairdner's yampah
APOCYNACEAE	*Apocynum sp.*	dogbane
ASCLEPIADACEAE	*Asclepias fascicularis*	Mexican milkweed
ASTERACEAE	*Achillea millefolium*	common yarrow
	Agoseris grandiflora	large-flowered agoseris
	Agoseris heterophylla	annual agoseris
	Antennaria dimorpha	low pussy-toes
	Antennaria flagellaris	stolonous everlasting
	Antennaria luzuloides	woodrush pussy-toes
	Antennaria microphylla	rosy pussy-toes
	Antennaria stenophylla	narrow-leaf pussy-toes
	* *Anthemis cotula*	mayweed chamomile
	Arnica cordifolia	heart-leaved arnica

ASTERACEAE	*Arnica fulgens*	orange arnica
	* *Artemisia absinthium*	wormwood
	Artemisia douglasiana	Douglas' sagewort
	Artemisia rigida	stiff sagebrush
	Balsamorhiza hookeri var. lagocephala	Hooker's balsamroot
	Balsamorhiza sagittata	arrow-leaf balsamroot
	Cacaliopsis nardosmia	silvercrown luina
	* *Centaurea biebersteinii*	spotted knapweed
	* *Centaurea diffusa*	diffuse knapweed
	Chaenactis douglasii	hoary chaenactis
	* *Cichorium intybus*	wild succory
	* *Cirsium arvense*	Canada thistle
	Cirsium hookerianum	Hooker's thistle
	Cirsium sp.	thistle
	* *Cirsium vulgare*	bull thistle
	Crepis atribarba	slender hawksbeard
	Crepis modocensis ssp. rostrata	low hawksbeard
	Crocidium multicaule	spring-gold
	Ericameria nauseosa ssp. nauseosa	gray rabbitbrush
	Erigeron bloomeri	scabland fleabane
	Erigeron filifolius var. filifolius	thread-leaf fleabane
	Erigeron linearis	line-leaf fleabane
	Erigeron poliospermus var. poliospermus	cushion fleabane
	Erigeron pumilus ssp. intermedius	shaggy fleabane
	Eriophyllum lanatum	common eriophyllum
	Gnaphalium palustre	lowland cudweed
	Grindelia sp.	gumweed
	Grindelia squarrosa	resin-weed
	Helianthella uniflora	Rocky Mountain helianthella
	Hieracium cynoglossoides	hounds-tounge hawkweed
	* *Lactuca serriola*	prickly lettuce
	Lagophylla ramosissima	slender hareleaf
	Leucanthemum vulgare	oxeye-daisy
	Madia citriodora	lemon-scented tarweed
	Madia exigua	little tarweed
	Madia glomerata	mountain tarweed
	Madia gracilis	gum-weed
	Matricaria discoidea	pineapple weed
	Microseris nutans	nodding microseris
	Nothocalais troximoides	false-agoseris
	Pyrrocoma carthamoides var. carthamoides	large-flowered goldenweed
	Rigiopappus leptocladus	bristle-head
	Senecio hydrophiloides	sweetmarsh butterweed
	Senecio integerrimus var. exaltatus	western groundsel
	Stenotus lanuginosus var. lanuginosus	woolly goldenweed
	Stenotus stenophyllus	narrow-leaf goldenweed

ASTERACEAE	*Symphyotrichum foliaceum*	leafy aster
	Symphyotrichum spathulatum	western mountain aster
	* *Taraxacum laevigatum*	red seeded dandelion
	* *Taraxacum officinale*	common dandelion
	* *Tragopogon dubius*	salsify
	Wyethia amplexicaulis	northern wyethia
	Xanthium strumarium	common cocklebur
BERBERIDACEAE	*Mahonia aquifolium*	shining Oregongrape
BETULACEAE	*Alnus viridis*	Sitka alder
	Betula sp.	birch
	Corylus cornuta	hazelnut
BORAGINACEAE	*Amsinckia lycopsoides*	tarweed fiddleneck
	Amsinckia menziesii	Menzies' fiddleneck
	* *Asperugo procumbens*	madwort
	* *Buglossoides arvensis*	corn gromwell
	Cryptantha torreyana	Torrey's cryptantha
	Lithospermum ruderale	Columbia puccoon
	Mertensia oblongifolia	leafy bluebells
	Myosotis laxa	small-flowered forget-me-not
	* *Myosotis stricta*	blue scorpion-grass
	Plagiobothrys scouleri	Scouler's plagiobothrys
	Plagiobothrys tenellus	slender popcorn-flower
BRASSICACEAE	* *Alyssum alyssoides*	pale alyssum
	Arabis sparsiflora var. atrorubens	elegant rockcress
	* *Capsella bursa-pastoris*	shepherd's-purse
	Cardaria draba	heart-podded hoarycress
	Descurainia incana	mountain tansymustard
	Draba verna	spring whitlow-grass
	Idahoa scapigera	scalepod
	* *Lepidium campestre*	fieldpeppergrass
	Phoenicaulis cheiranthoides	daggerpod
	Rorippa curvisiliqua	western yellowcress
	* *Rorippa nasturtium-aquaticum*	water-cress
	* *Sisymbrium altissimum*	Jim Hill mustard
	* *Thlaspi arvense*	fanweed
CAPRIFOLIACEAE	*Lonicera ciliosa*	trumpet honeysuckle
	Sambucus nigra ssp. cerulea	blue elderberry
	Symphoricarpos oreophilus var. utahensis	mountain snowberry
CARYOPHYLLACEAE	*Arenaria congesta var. prolifera*	capitate sandwort

CARYOPHYLLACEAE	*Cerastium nutans*	nodding chickweed
	* *Dianthus armeria*	grass pink
	* *Holosteum umbellatum*	jagged chickweed
	Moehringia macrophylla	bigleaf sandwort
	Sagina saginoides	alpine pearlwort
	* *Silene latifolia ssp. alba*	white campion
	Silene menziesii ssp. menziesii	Menzie's silene
	* *Spergularia rubra*	red sandspurry
	Stellaria longipes	longstalk starwort
CELASTRACEAE	*Paxistima myrsinites*	myrtle boxwood
CHENOPODIACEAE	*Chenopodium album*	lamb's quarters
	Chenopodium leptophyllum	slimleaf goosefoot
	Chenopodium sp.	lamb's quarters
	* *Salsola kali*	Russian thistle
CONVOLVULACEAE	* *Convolvulus arvensis*	field bindweed
CORNACEAE	*Cornus sericea*	red-osier dogwood
CRASSULACEAE	*Sedum lanceolatum*	lance-leaved stonecrop
CYPERACEAE	*Carex aquatilis*	water sedge
	Carex bebbii	Bebb's sedge
	Carex geyeri	elk sedge
	Carex lenticularis	lakeshore sedge
	Carex microptera	small winged sedge
	Carex multicostata	many-ribbed sedge
	Carex pachystachya	thick headed sedge
	Carex pellita	wooly sedge
	Carex praegracilis	graceful sedge
	Carex retrorsa	retrorse sedge
	Carex sp.	sedge
	Carex stipata	sawbeak sedge
	Eleocharis palustris	common spike-rush
	Scirpus microcarpus	small-fruited bulrush
EQUISETACEAE	*Equisetum arvense*	common horsetail
FABACEAE	*Astragalus reventiformis*	Yakima milkvetch
	* *Daucus carota*	Queen Anne's lace
	Lathyrus pauciflorus var. pauciflorus	few-flowered peavine
	Lotus pinnatus	meadow deervetch
	Lupinus argenteus ssp. argenteus var. laxiflorus	spurred lupine

FABACEAE	*Lupinus lepidus*	prairie lupine
	Lupinus sericeus ssp. sericeus var. flexuosus	silky lupine
	* *Medicago lupulina*	hop clover
	* *Melilotus alba*	white sweet-clover
	Trifolium cyathiferum	cup clover
	* *Trifolium hybridum*	alsike clover
	Trifolium macrocephalum	big-headed clover
	* *Trifolium pratense*	red clover
	Vicia americana ssp. americana	American vetch
FAGACEAE	*Quercus garryana*	Oregon white oak
GERANIACEAE	* *Erodium cicutarium*	filaree
	Geranium viscosissimum	sticky purple geranium
GROSSULARIACEAE	*Ribes cereum var. cereum*	squaw currant
HYDRANGEACEAE	*Philadelphus lewisii*	mockorange
HYDROPHYLLACEAE	*Hesperochiron pumilus*	dwarf hesperochiron
	Hydrophyllum capitatum	ball-head waterleaf
	Nemophila breviflora	great basin nemophila
	Phacelia hastata	silverleaf phacelia
	Phacelia linearis	threadleaf phacelia
	Phacelia procera	tall phacelia
HYPERICACEAE	* *Hypericum perforatum*	common St. Johnswort
IRIDACEAE	*Iris missouriensis*	western blue fleur-de-lis
	Sisyrinchium sp.	sisyrinchium
JUNCACEAE	*Juncus articulatus*	jointed rush
	Juncus balticus	Baltic rush
	Juncus brachyphyllus	shortleaved rush
	Juncus bufonius	toad rush
	Juncus covillei var. obtusatus	Coville's rush
	Juncus effusus	common rush
	Juncus ensifolius	dagger leaved rush
	Juncus longistylis	long styled rush
LAMIACEAE	*Mentha arvensis*	field mint
	Monardella odoratissima ssp. discolor	mountain monardella
	Prunella vulgaris ssp. lanceolata	self-heal
LEMNACEAE	*Lemna minor*	water lentil

LILIACEAE	*Allium acuminatum*	tapertip onion
	Allium douglasii	Douglas' onion
	Allium macrum	rock onion
	Allium tolmiei	Tolmie's onion
	Calochortus sp.	mariposa
	Camassia quamash	common camas
	Fritillaria pudica	yellow bell
	Maianthemum racemosum ssp. amplexicaule	western Soloman-plume
	Maianthemum stellatum	starry Solomon-plume
	Triteleia grandiflora var. howellii	Howell's triteleia
	Veratrum californicum	California false hellebore
	Zigadenus venenosus	meadow death camas
LOASACEAE	*Mentzelia dispersa*	small-flowered mentzelia
MALVACEAE	*Malva neglecta*	dwarf mallow
	Sidalcea oregana ssp. oregana var. NOT calva	Oregon checker-mallow
ONAGRACEAE	*Camissonia andina*	sun cup
	Chamerion angustifolium	fireweed
	Epilobium brachycarpum	tall annual willow-weed
	Epilobium ciliatum	purple-leaved willowherb
	Epilobium densiflorum	dense spike-primrose
	Epilobium minutum	small flowered willow-weed
OROBANCHACEAE	*Orobanche uniflora*	naked broomrape
PAEONIACEAE	*Paeonia brownii*	Brown's peony
PINACEAE	*Pinus ponderosa*	ponderosa pine
	Pseudotsuga menziesii	Douglas-fir
PLANTAGINACEAE	* *Plantago lanceolata*	ribwort
POACEAE	*Achnatherum lemmonii var. lemmonii*	Lemmon's needlegrass
	Agrostis exarata	spike bentgrass
	* *Agrostis gigantea*	redtop
	* *Alopecurus pratensis*	meadow foxtail
	Bromus carinatus	California brome
	* *Bromus commutatus*	hairy chess
	* *Bromus diandrus*	ripgut
	* *Bromus hordeacus ssp. hordeacus*	soft brome
	Bromus inermis	smooth brome
	* *Bromus japonicus*	Japanese brome

POACEAE	* *Bromus tectorum*	cheatgrass
	Bromus vulgaris var. vulgaris	Columbia brome
	* *Dactylis glomerata*	orchard grass
	Danthonia unispicata	one-spike oatgrass
	Deschampsia danthonioides	annual hairgrass
	Deschampsia elongata	slender hairgrass
	Elymus elymoides	bottlebrush squirreltail
	Elymus glaucus	western rye-grass
	Elymus multisetus	big squirreltail
	* *Elymus repens*	quack grass
	Festuca idahoensis	idaho fescue
	Glyceria striata	fowl mannagrass
	Hordeum brachyantherum	meadow barley
	* *Hordeum marinum*	Mediterranean barley
	Leymus cinereus	giant wildrye
	* *Lolium pratense*	meadow ryegrass
	Melica bulbosa	oniongrass
	Melica fugax	little oniongrass
	Phalaris arundinacea	reed canarygrass
	* *Phleum pratense*	timothy
	* *Poa bulbosa*	bulbous bluegrass
	Poa pratensis	Kentucky bluegrass
	Poa secunda	Sandberg's bluegrass
	Poa wheeleri	Wheeler's bluegrass
	Pseudoroegneria spicata	blue-bunch wheatgrass
	* *Ventenata dubia*	ventenata
	* *Vulpia bromoides*	brome fescue
POLEMONIACEAE	*Collomia grandiflora*	large flowered collomia
	Collomia linearis	narrow-leaf collomia
	Navarretia intertexta ssp. propinqua	needle-leaf navarretia
	Navarretia sp.	navarretia
	Phlox gracilis ssp. humilis	slender phlox
	Phlox hoodii	Hood's phlox
	Phlox speciosa	showy phlox
	Polemonium micranthum	littlebells polemonium
POLYGONACEAE	*Eriogonum compositum var. leianthum*	northern buckwheat
	Eriogonum douglasii	Douglas' buckwheat
	Eriogonum elatum	tall buckwheat
	Eriogonum heracleoides	Wyeth's buckwheat
	Eriogonum sp.	buckwheat
	Eriogonum strictum ssp. proliferum	strict buckwheat
	Eriogonum thymoides	thyme buckwheat
	Polygonum aviculare	doorweed
	Polygonum douglasii	Douglas' knotweed

POLYGONACEAE	*Polygonum polygaloides ssp. kelloggii*	white-margined knotweed
	* *Rumex acetosella*	field sorrel
	Rumex salicifolius var. mexicanus	willow dock
POLYPODIACEAE	*Cystopteris fragilis*	bladder-fern
PORTULACACEAE	*Claytonia lanceolata var. lanceolata*	western springbeauty
	Claytonia perfoliata	miner's lettuce
	Lewisia rediviva	bitterroot
	Montia fontana	water chickweed
	Montia linearis	line-leaf montia
PRIMULACEAE	*Dodecatheon conjugens*	desert shooting-star
RANUNCULACEAE	* *Ceratocephala testiculata*	hornseed buttercup
	Delphinium multiplex	Kittitas larkspur
	Delphinium nuttallianum	larkspur
	Myosurus minimus	tiny mouse-tail
	Ranunculus aquatilis	white water-buttercup
	Ranunculus sceleratus	celeryleaved buttercup
	Ranunculus uncinatus	little buttercup
RHAMNACEAE	*Ceanothus sanguineus*	redstem ceanothus
	Ceanothus velutinus var. velutinus	snowbrush
ROSACEAE	*Amelanchier alnifolia*	western service berry
	Crataegus douglasii	black hawthorn
	Geum triflorum	old man's whiskers
	Holodiscus discolor	oceanspray
	Potentilla glandulosa	sticky cinquefoil
	Potentilla gracilis var. fastigiata	slender cinquefoil
	Potentilla gracilis var. flabelliformis	cinquefoil
	Prunus emarginata	bittercherry
	Prunus virginiana	chokecherry
	Purshia tridentata	bitter-brush
	Rosa nutkana	Nootka rose
	Rosa woodsii	Wood's rose
	Rubus parviflorus	thimbleberry
	Sanguisorba occidentalis	annual burnet
RUBIACEAE	*Galium aparine*	cleavers
	Galium boreale	northern bedstraw
	Galium trifidum	small bedstraw
SALICACEAE	*Populus balsamifera ssp. trichocarpa*	black cottonwood

SALICACEAE	*Populus tremuloides*	aspen
	Salix lucida ssp. caudata	whiplash willow
	Salix prolixa	Mackenzie willow
SANTALACEAE	*Comandra umbellata*	bastard toad flax
SAXIFRAGACEAE	*Lithophragma glabrum*	bulbiferous fringecup
	Lithophragma parviflorum	prairiestar
	Saxifraga integrifolia	swamp saxifrage
SCROPHULARIACEAE	*Castilleja hispida var. hispida*	harsh paintbrush
	Castilleja tenuis	hairy indian-paintbrush
	Castilleja thompsonii	Thompson's paintbrush
	Collinsia parviflora	blue-eyed mary
	Mimulus breviflorus	short-flowered monkey-flower
	Mimulus moschatus var. moschatus	musk-plant
	Penstemon gairdneri var. gairdneri	Gairdner's penstemon
	Penstemon richardsonii var. richardsonii	Richardson's penstemon
	Penstemon rydbergii	Rydberg's penstemon
	* *Verbascum thapsus*	common mullein
	Veronica americana	American brooklime
	Veronica peregrina ssp. xalapensis	purslane speedwell
SOLANACEAE	*Solanum triflorum*	cut-leaved nightshade
VIOLACEAE	*Viola nuttallii*	yellow violet
	Viola trinervata	sagebrush violet